

SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

2102-F-21-R-42

Name: East Vermillion Lake

County: McCook

Legal Description: T102N-R53W-Sec. 14-15, 22-23, 26-27, 33-35

Location from nearest town: 5 miles east, 1 mile south of Canistota, SD

Dates of present survey: July 13-15, 2009 (netting); Sept. 15, 2009 (electrofishing)

Dates of last survey: July 15-17, 2008 (netting); October 7, 2008 (electrofishing)

Primary Game Species	Other Species
Walleye	Largemouth Bass
Black Crappie	Yellow Perch
Bluegill	White Crappie
	Northern Pike
	Channel Catfish
	Common Carp
	White Sucker
	Black Bullhead
	Freshwater Drum

PHYSICAL DATA

Surface area: 513 acres

Maximum depth: 23 feet

Volume: 6,600 acre feet

Contour map available? Yes

Lake elevation observed during the survey: Full

Watershed area: 264,789 acres

Mean depth: 12 feet

Shoreline length: 10.1 miles

Date prepared: 1974

Beneficial use classification: (4) warmwater permanent fish propagation, (7) immersion recreation, (8) limited-contact recreation, (9) fish and wildlife propagation and stock watering.

Introduction

East Vermillion Lake, commonly known as Lake Vermillion, is an impoundment formed by the construction of a dam across the East Vermillion River in 1958. Battle Creek is a secondary tributary that forms the west arm of the lake. A low-level outlet gate can be opened for flood control and dam maintenance purposes. In April and July 1993, the primary and secondary spillways suffered significant damage during flood events. In March 1994, the primary spillway was undermined and collapsed due to the previous year's damage. The primary spillway was repaired by spring 1995.

Ownership of Lake and Adjacent Lakeshore Properties

East Vermillion Lake is owned and managed by the Parks and Wildlife Divisions of the South Dakota Department of Game, Fish and Parks (GFP). Together, the two divisions own 1,826 acres which includes the surface area of the lake. Public use easements grant the public the right to access and use a strip of land 50 feet wide outside the high water contour of the lake.

Fishing Access

The West Recreation Area, a fee area managed by the Parks Division, has a double lane boat ramp with a dock, public toilet, handicapped fishing dock, modern campground, fish cleaning station, swimming beach, and shore fishing access. There is vehicle access to shore-fishing areas in the western arm of the lake. The East Recreation Area, also a fee area managed by the Parks Division, has a double lane boat ramp with a dock, public toilet, campground, and shore fishing access.

Field Observations of Water Quality and Aquatic Vegetation

Scattered beds of sago pondweed (*Potamogeton pectinatus*) were common throughout the lake. Cattails (*Typha spp.*) and duckweed (*Lemna spp.*) were also observed. The water was fairly clear with a Secchi depth measurement of 71 cm (28 in).

BIOLOGICAL DATA

Methods:

East Vermillion Lake was sampled on July 13-15, 2009 with four overnight gill-net sets and ten overnight trap-net sets. The trap nets are constructed with 19-mm-bar-mesh ($\frac{3}{4}$ in) netting, 0.9 m high x 1.5 m wide (3 ft high x 5 ft wide) frames and 18.3 m (60 ft) long leads. The gill nets are 45.7 m long x 1.8 m deep (150 ft long x 6 ft deep) with one 7.6 m (25 ft) panel each of 13, 19, 25, 32, 38 and 51-mm-bar-mesh ($\frac{1}{2}$, $\frac{3}{4}$, 1, $1\frac{1}{4}$, $1\frac{1}{2}$, and 2 in) monofilament netting. One hour and forty minutes of nighttime electrofishing was done on Sept. 15, 2009 to evaluate walleye recruitment. Sampling locations are displayed in Figure 5.

Gill Net Catch

Black bullheads comprised 82.9% of the gill net catch this year (Table 1). Other species sampled included white sucker, walleye, channel catfish, yellow perch, common carp, black crappie, northern pike, and orange spotted sunfish.

Table 1. Total catch from four overnight gill net sets at East Vermillion Lake, McCook County, July 13-15, 2009.

Species	No.	%	CPUE ¹	80% C.I.	Mean CPUE*	PSD	RSD-P	Mean Wr
Black Bullhead	525	82.9	131.3	±17.0	121.4	1	0	104
White Sucker	40	6.3	10.0	±0.5	5.3	100	98	111
Walleye	29	4.6	7.3	±3.4	11.8	21	4	94
Channel Catfish	22	3.5	5.5	±1.9	2.9	80	0	113
Yellow Perch	11	1.7	2.8	±1.1	20.4	45	0	119
Common Carp	3	0.5	0.8	±1.0	1.2	--	--	--
Black Crappie	1	0.2	0.3	±0.3	1.0	--	--	--
Northern Pike	1	0.2	0.3	±0.3	1.4	--	--	--
O. S. Sunfish	1	0.2	0.3	±0.3	0.0	--	--	--

* 10 years (1999-2008)

¹ See Appendix A for definitions of CPUE, PSD, and mean Wr.

Table 2. Catch per unit effort by length category for various fish species captured with gill nets in East Vermillion Lake July 13-15, 2009.

Species	Substock	Stock	S-Q	Q-P	P+	All sizes	80% C.I.
Black Bullhead	2.5	129.3	128.0	1.3	--	131.3	±17.0
White Sucker	--	10.0	--	0.3	9.7	10.0	±0.5
Walleye	--	7.0	5.5	1.3	0.2	7.3	±3.4
Channel Catfish	--	5.5	0.5	5.0	--	5.5	±1.9
Yellow Perch	--	2.8	1.5	1.3	--	2.8	±1.1
Common Carp	--	0.8	--	0.3	0.5	0.8	±1.0
Black Crappie	--	0.3	0.3	--	--	0.3	±0.3
Northern Pike	--	0.3	--	0.3	--	0.3	±0.3
O. S. Sunfish*	--	--	--	--	--	0.3	±0.3

*No length categories established. Length categories can be found in Appendix A.

Trap Net Catch

Black bullheads were also the most abundant species sampled in the trap nets (Table 2). Ten additional species were also sampled.

Table 3. Total catch from ten overnight trap net sets at East Vermillion Lake, McCook County, July 13-15, 2009.

Species	No.	%	CPUE	80% C.I.	Mean CPUE*	PSD	RSD-P	Mean Wr
Black Bullhead	4,914	98.1	491.4	±260.2	634.0	8	0	88
White Sucker	52	1.0	5.2	±2.9	2.6	100	92	101
Walleye	17	0.3	1.7	±1.0	1.6	35	6	88
Bluegill	8	0.2	0.8	±0.9	11.8	--	--	--
Black Crappie	5	0.1	0.5	±0.3	6.1	--	--	--
Channel Catfish	3	0.1	0.3	±0.3	3.1	--	--	--
Common Carp	3	0.1	0.3	±0.4	4.2	--	--	--
Northern Pike	3	0.1	0.3	±0.4	2.3	--	--	--
Freshwater Drum	1	0.0	0.1	±0.1	0.0	--	--	--
White Crappie	1	0.0	0.1	±0.1	1.5	--	--	--
Yellow Perch	1	0.0	0.1	±0.1	1.7	--	--	--

* 10 years (1999-2008)

Table 4. Catch per unit effort by length category for various fish species captured with trap nets in East Vermillion Lake July 13-15, 2009.

Species	Substock	Stock	S-Q	Q-P	P+	All sizes	80% C.I.
Black Bullhead	117.6	373.8	344.2	29.6	--	491.4	±260.2
White Sucker	--	5.2	--	0.4	4.8	5.2	±2.9
Walleye	--	1.7	1.1	0.5	0.1	1.7	±1.0
Bluegill	--	0.8	0.2	--	0.6	0.8	±0.9
Black Crappie	0.2	0.3	0.2	0.1	--	0.5	±0.3
Channel Catfish	0.1	0.2	0.1	0.1	--	0.3	±0.3
Common Carp	--	0.3	--	--	0.3	0.3	±0.4
Northern Pike	--	0.3	0.2	0.1	--	0.3	±0.4
Freshwater Drum	--	0.1	0.1	--	--	0.1	±0.1
White Crappie	--	0.1	--	--	0.1	0.1	±0.1
Yellow Perch	--	0.1	--	--	0.1	0.1	±0.1

Length categories can be found in Appendix A.

Walleye

Management objective: Maintain a walleye fishery with a gill-net CPUE of at least 15 and PSD range of 30-60.

Walleye gill-net CPUE was below the 10-year mean in 2009 and mostly age-3 fish were sampled (Table 6). Overall, growth of age-2 and age-3 walleyes was slower than other years and other lakes in the region (Table 6) but condition (Wr) was above average (Table 5).

Table 5. Walleye gill net CPUE, PSD, RSD-P and mean Wr in East Vermillion Lake, McCook County, 2000-2009.

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Mean*
CPUE	9.2	14.5	17.5	8.3	4.8	9.8	17.8	8.8	10.0	7.3	11.8
PSD	31	42	53	78	89	50	60	59	0	21	51
RSD-P	3	7	8	25	28	15	4	15	0	4	11
Mean Wr	87	83	91	90	88	92	98	86	89	94	89

*10 years (1999-2008)

Table 6. Weighted mean length at capture (mm) for walleye captured in gill nets in East Vermillion Lake, McCook County, 2003-2009. Note: sampling was conducted at approximately the same time during each year allowing comparisons among years to monitor growth trends. Sample size in parentheses.

Year	1	2	3	4	5	6	7	8	9	10	11	12
2009 (28)	--	291 (4)	351 (23)	555 (1)	--	--	--	--	--	--	--	--
2008 (40)	216 (2)	290 (37)	372 (1)	--	--	--	--	--	--	--	--	--
2007 (35)	270 (6)	323 (5)	387 (5)	392 (5)	461 (2)	446 (2)	468 (3)	518 (3)	552 (1)	629 (2)	478 (1)	--
2006 (71)	229 (18)	325 (19)	418 (20)	--	448 (5)	457 (5)	510 (3)	--	531 (1)	--	--	--
2005 (34)	288 (10)	369 (9)	--	440 (8)	467 (2)	522 (3)	596 (1)	641 (1)	--	--	--	--
2004 (19)	249 (3)	--	391 (2)	461 (6)	505 (4)	557 (1)	505 (1)	613 (2)	--	--	--	--
2003 (32)	--	299 (4)	400 (10)	446 (7)	486 (4)	535 (3)	587 (2)	626 (2)	--	--	--	--

Fall electrofishing indicates that natural reproduction produced a large year class in 2009 (Table 7). The age-0 walleyes were large and in good condition. The few age-1 fish sampled were small for their age, although their condition was good. This observation, combined with the slow growth of age-2 and age-3 fish documented for walleyes sampled in the gill nets seems to indicate a shortage of suitable forage. It is also interesting to note that the walleye population is sustained almost entirely by natural reproduction. The 2005 fingerling stocking did not produce a significant year class and although a large year class was produced in 2006, oxytetracycline marking showed only 8% of those fish were stocked (Table 7).

Table 7. Age-0 and age-1 walleyes sampled during 1 hour and forty minutes of nighttime electrofishing on East Vermillion Lake, McCook County, 2000-2009.

Year	Stocking	Age-0 CPH	80% C.I.	% stocked	Mean length (range; mm)	Wr	Age-1 CPH	80% C.I.	Mean length (range; mm)	Wr
2009	none	164	83-245		174 (135-190)	97	7	2-12	206 (205-211)	98
2008	none	35	13-57		188 (170-215)	98	2	0-5	226 (226-226)	83
2007	none	23	8-38		151 (131-151)	75	156	78-234	221 (171-262)	81
2006	fingerling	326	213-439	8	144 (116-205)	85	2	0-6	254 (212-268)	92
2005	none*	39	27-51		201 (152-230)	98	3	1-5	228 (220-230)	93
2004	none	44	34-54		193 (154-215)	86	1	0-2	303 (290-315)	86
2003	none	84	60-108		178 (134-209)	97	1	0-2	272 (255-286)	87
2002	none	7	2-12		169 (161-185)	96	196	138-254	271 (224-315)	89
2001	none	202	136-268		169 (129-216)	94	43	28-57	296 (245-330)	91
2000	none	231	117-345		200 (150-228)	103				

*16,544 large fingerlings were stocked in October 2005 after electrofishing

Black Crappie

Management objective: Maintain a black crappie fishery with a trap net CPUE of at least 20 and PSD of at least 40.

Black crappie trap-net CPUE remains low due to several years of poor natural recruitment (Table 8). The management objective for CPUE has been achieved only four times since 1990. Black crappies were stocked in East Vermillion Lake in 2009, the first time since 1996 (Table 12).

Table 8. Black crappie trap-net CPUE, PSD, and mean Wr in East Vermillion Lake, McCook County, 2000-2009.

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Mean*
CPUE	10.4	20.9	14.5	2.2	0.5	0.3	1.1	0.9	0.3	0.5	6.1
PSD	99	23	93	95	--	--	--	--	--	--	63
RSD-P	5	19	2	15	--	--	--	--	--	--	9
Mean Wr	118	167	119	107	--	--	--	--	--	--	129

*10 years (1999-2008)

Bluegill

Management objective: Maintain a bluegill fishery with a trap net CPUE of at least 20 and RSD-18 of at least 20.

Bluegill trap-net CPUE decreased to the lowest level seen since 1991 due to several consecutive years of poor natural recruitment (Table 9). The management objective of 20 per net has only been reached twice since 1990. Bluegills were stocked in the fall of 2009, the first time since 1996.

Table 9. Bluegill trap-net CPUE, PSD, RSD-18, RSD-P, and mean Wr in East Vermillion Lake, McCook County, 2000-2009.

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Mean*
CPUE	2.9	9.2	21.0	41.1	14.7	6.6	4.9	2.5	3.6	0.8	11.8
PSD	74	13	100	100	100	100	44	96	97	--	80
RSD-18	43	2	63	98	99	100	33	32	94	--	64
RSD-P	35	1	51	55	78	97	33	28	69	--	49
Mean Wr	141	138	128	112	110	115	131	122	114	--	124

*10 years (1999-2008)

Black Bullhead

Management objective: Maintain a black bullhead population with a trap-net CPUE of less than 100.

Black bullhead trap-net CPUE returned to levels seen in 2007 (Table 10). Only 8% of the bullheads sampled were more than 23 cm (9 inches) long (Table 8 and Figure 4). Age-0 black bullheads were observed during the survey possibly indicating production of another strong year class. A GFP-subsidized commercial fisherman has removed approximately 25,000 pounds (50 pounds/acre) of bullheads each of the last eight years in an attempt to control the population but the effort has been largely ineffective.

Table 10. Black bullhead trap-net CPUE and PSD for East Vermillion Lake, McCook County, 2000-2009.

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Mean*
CPUE	107.6	291.8	190.2	473.1	1,574.0	258.8	2,718.8	534.1	78.9	491.4	634.0
PSD	89	30	58	27	19	91	2	2	83	8	48
RSD-P	13	9	7	1	0	0	0	0	0	0	4
Mean Wr	90	100	102	98	93	93	89	90	94	88	94
Avg. Length mm	171	223	216	213	244	157	196	221	167	205	

*10 years (1999-2008)

All Species

Yellow perch CPUE was the lowest ever recorded. CPUE for all other species was within previously observed ranges (Table 11).

Table 11. Gill-net (GN) and trap-net (TN) CPUE for all fish species sampled in East Vermillion Lake, McCook County, 2000-2009.

Species	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
COC (GN)	0.2	1.2	0.5	0.3	0.3	0.8	3.0	3.8	2.0	0.8
COC (TN)	4.4	1.5	6.4	1.2	1.4	6.3	2.3	8.2	7.5	0.3
WHS (GN)	9.0	5.7	0.7	4.5	2.8	4.5	3.0	8.3	10.0	10.0
WHS (TN)	9.2	1.4	4.4	0.8	0.1	1.7	2.1	1.6	2.5	5.2
BLB (GN)	59.5	70.5	146.5	233.3	169.5	124.0	174.5	98.8	86.8	131.3
BLB (TN)	107.6	291.8	190.2	473.1	1574	258.8	2718.8	534.1	78.9	491.4
CCF (GN)	0.7	0.2	0.7	3.5	1.5	5.0	10.8	2.8	3.8	5.5
CCF (TN)	0.7	0.2	0.2	4.7	9.2	6.6	3.1	3.1	2.7	0.3
NOP (GN)	2.5	1.0	2.5	--	0.3	0.8	--	0.5	0.8	0.3
NOP (TN)	5.0	1.6	8.6	1.3	1.2	0.6	1.3	0.2	1.0	0.3
OSF (GN)	--	--	--	--	--	--	--	--	--	0.3
GSF (TN)	--	--	0.1	--	--	--	0.3	0.1	0.1	--
BLG (GN)	--	0.5	1.2	--	0.5	--	--	--	--	--
BLG (TN)	2.9	9.2	21.0	41.1	14.7	6.6	4.9	2.5	3.6	0.8
HYB (TN)	--	--	0.2	0.1	--	--	--	--	--	--
SMB (TN)	0.4	--	--	--	--	--	--	--	--	--
LMB (TN)	0.1	--	0.5	0.1	0.3	0.3	0.3	--	--	--
WHC (GN)	0.2	2.7	2.5	--	0.3	0.3	0.3	--	--	--
WHC (TN)	0.4	4.4	6.4	1.3	1.2	0.3	--	0.2	--	0.1
BLC (GN)	1.0	1.7	3.2	0.8	0.3	--	0.3	--	0.3	0.3
BLC (TN)	10.4	20.9	14.5	2.2	0.5	0.3	1.1	0.9	0.3	0.5
YEP (GN)	8.0	47.2	42.5	28.8	21.3	8.8	6.3	7.3	11.5	2.8
YEP (TN)	1.5	4.0	4.7	1.6	0.6	0.4	1.5	0.7	0.1	0.1
WAE (GN)	9.2	14.5	17.5	8.3	4.8	9.8	17.8	8.8	10.0	7.3
WAE (TN)	1.6	1.4	3.9	2.1	1.3	0.3	0.1	2.2	2.2	1.7
FRD (GN)	--	--	--	--	--	--	0.3	--	--	--
FRD (TN)	--	--	--	--	--	--	--	--	0.1	0.1

COC (Common Carp), WHS (White Sucker), BLB (Black Bullhead), CCF (Channel Catfish), NOP (Northern Pike), GSF (Green Sunfish), BLG (Bluegill), HYB (Hybrid Sunfish), SMB (Smallmouth Bass), LMB (Largemouth Bass), WHC (White Crappie), BLC (Black Crappie), YEP (Yellow Perch), WAE (Walleye), FRD (Freshwater Drum)

MANAGEMENT RECOMMENDATIONS

1. Continue to monitor East Vermillion Lake with annual summer netting surveys to sample adult fish populations and fall electrofishing surveys to monitor walleye recruitment.
2. Develop a habitat improvement plan for East Vermillion Lake that may include periodic drawdowns, artificial structures, rock spawning reefs and fishing piers.
3. Investigate potential reasons for the poor crappie and bluegill recruitment in recent years.

Table 12. Stocking record for East Vermillion Lake, McCook County, 1991-2009.

Year	Number	Species	Size
1991	6,700	Walleye	Sml. Fingerling
	6,000	Walleye	Lrg. Fingerling
1992	15,000	Largemouth Bass	Sml. Fingerling
	40,690	Largemouth Bass	Med. Fingerling
	12,824	Walleye	Lrg. Fingerling
	902	Walleye	Juvenile
	109	Walleye	Adult
	38,930	Yellow Perch	Fingerling
1995	1,350	Black Crappie	Adult
	27,500	Channel Catfish	Fingerling
	35,700	Fathead Minnow	Adult
	55,000	Walleye	Sml. Fingerling
	3,789	Black Crappie	Adult
1996	51,300	Bluegill	Fingerling
	51,300	Channel Catfish	Fingerling
	5,227	Yellow Perch	Fingerling
	102,600	Walleye	Fingerling
1999	51,300	Walleye	Fingerling
2005	16,544	Walleye	Fingerling
2006	51,425	Walleye	Fingerling
2009	1,661	Black Crappie	Adult
	1,187	Bluegill	Adult

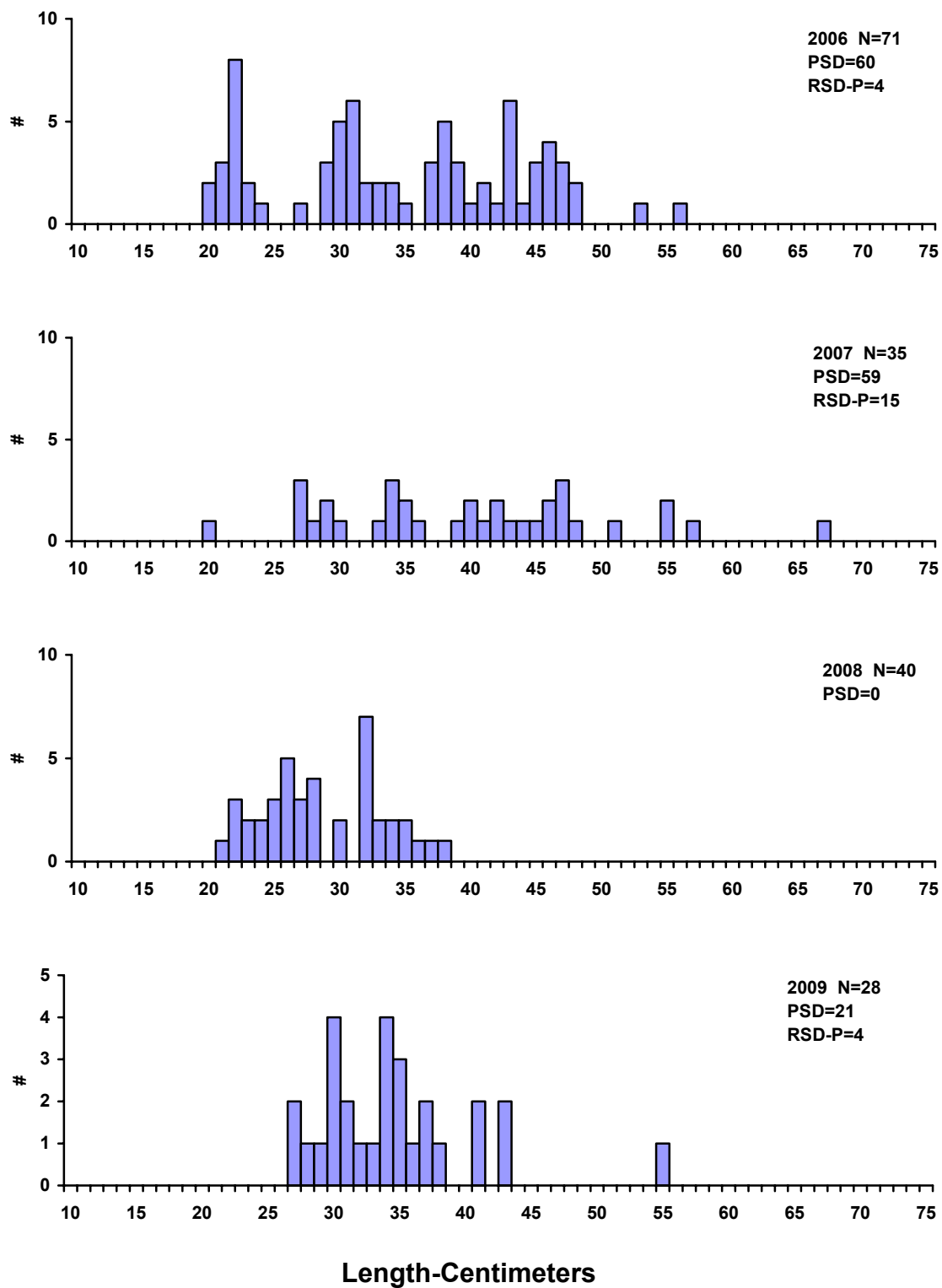


Figure 1. Length frequency histograms for walleye sampled with gill nets in East Vermillion Lake, McCook County, 2006-2009.

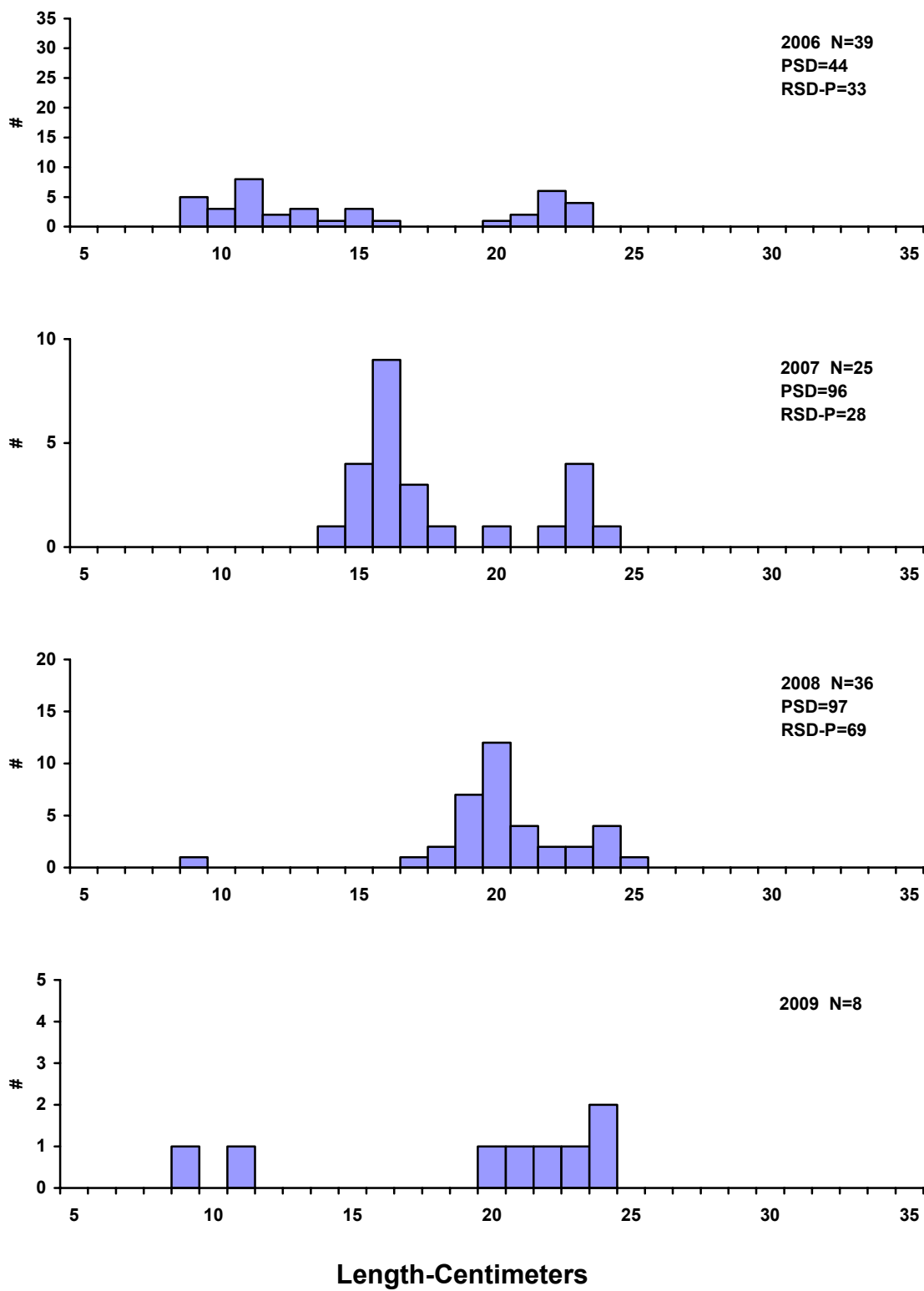


Figure 2. Length frequency histograms for bluegills sampled with trap nets in East Vermillion Lake, McCook County, 2006-2009.

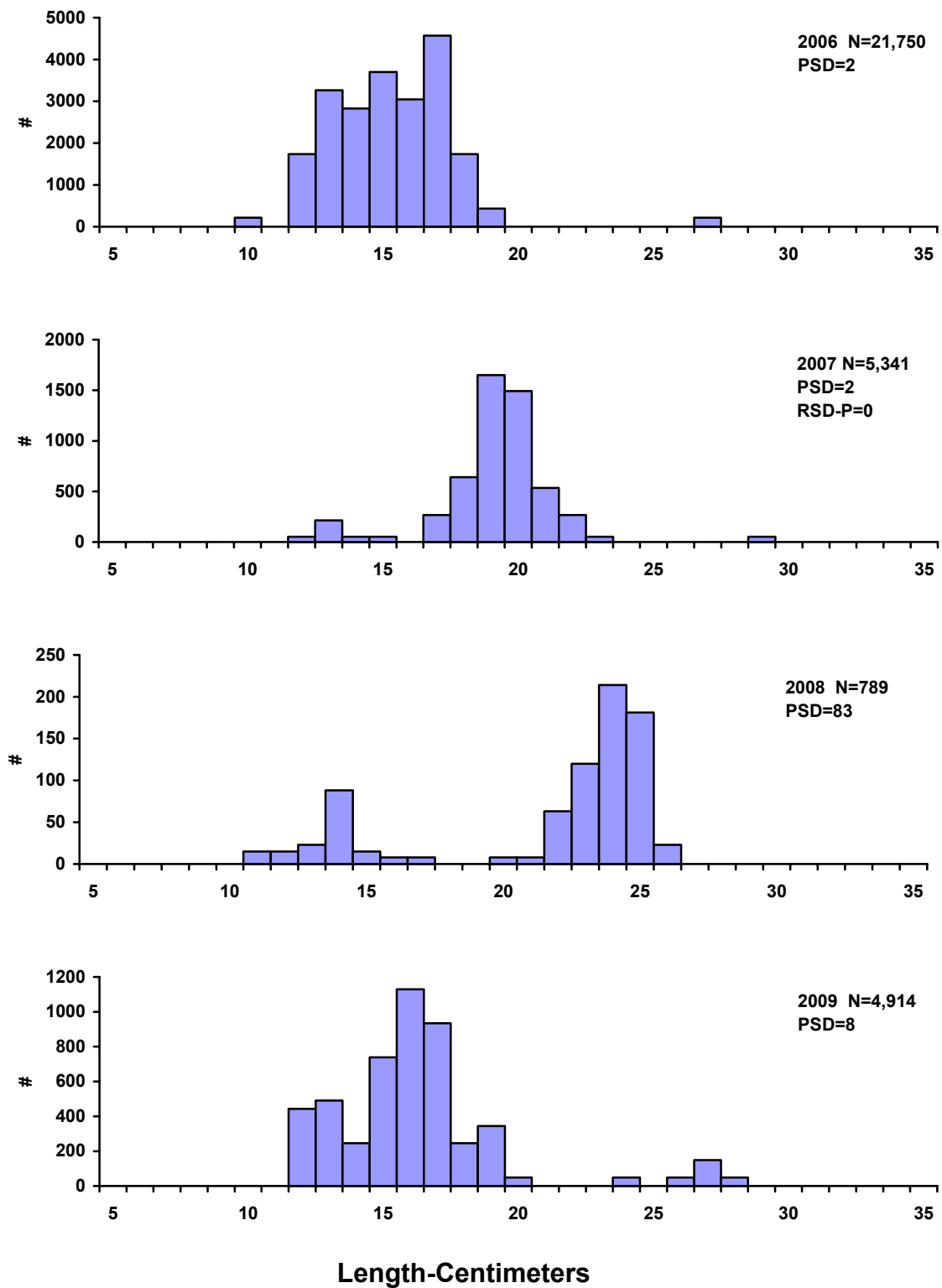
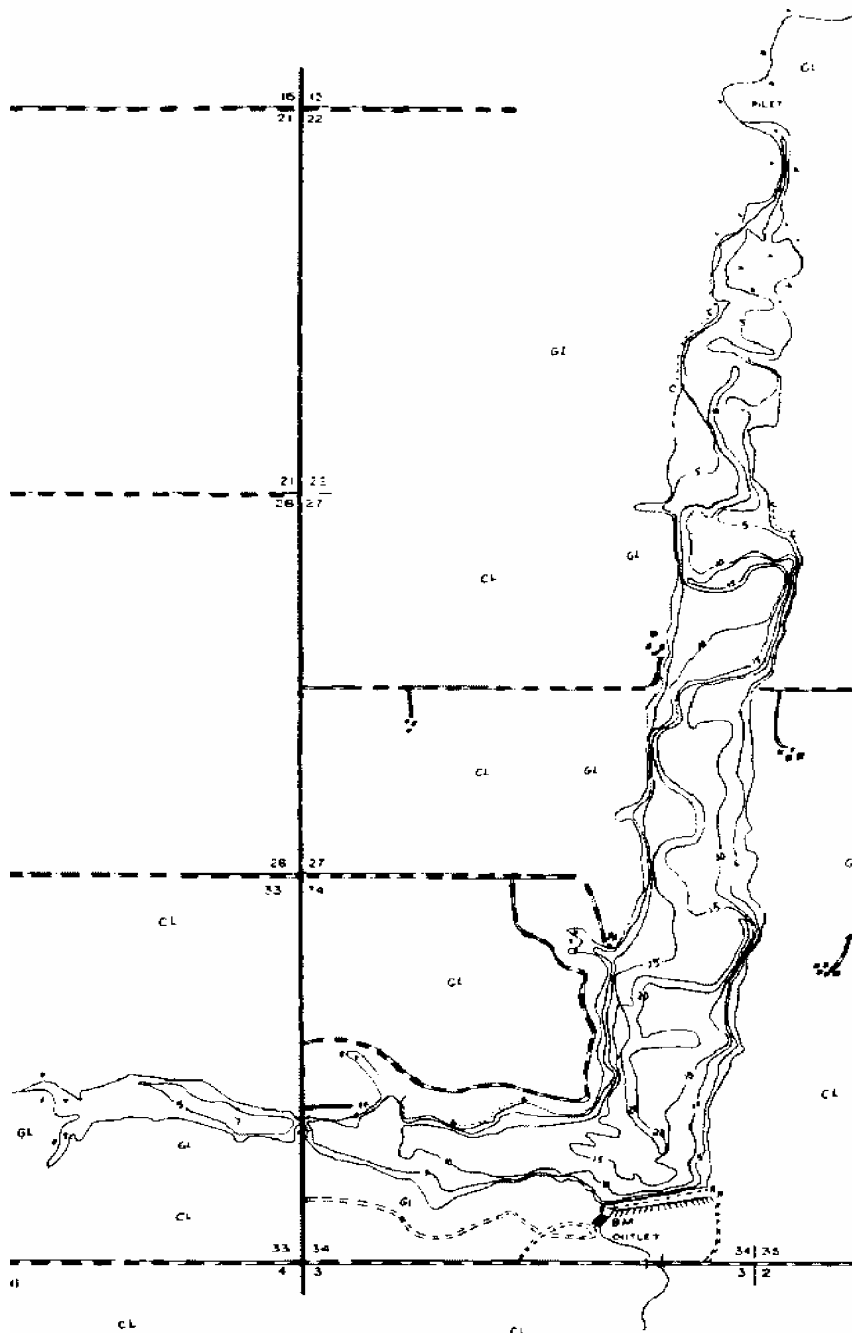


Figure 3. Length frequency histograms for black bullheads sampled with trap nets in East Vermillion Lake, McCook County, 2006-2009.



Appendix A. A brief explanation of catch per unit effort (CPUE), proportional stock density (PSD), relative stock density (RSD) and relative weight (Wr).

Catch Per Unit Effort (CPUE) is the catch of animals in numbers or in weight taken by a defined period of effort. Can refer to trap-net nights of effort, gill-net nights of effort, catch per hour of electrofishing, etc.

Proportional Stock Density (PSD) is calculated by the following formula:

$$\text{PSD} = \frac{\text{Number of fish} > \text{quality length}}{\text{Number of fish} \geq \text{stock length}} \times 100$$

Relative Stock Density (RSD-P) is calculated by the following formula:

$$\text{RSD-P} = \frac{\text{Number of fish} > \text{preferred length}}{\text{Number of fish} \geq \text{stock length}} \times 100$$

PSD and RSD-P are unitless and usually calculated to the nearest whole digit.

Size categories for selected species found in Region 3 lake surveys, in centimeters.

Species	Stock	Quality	Preferred	Memorable	Trophy
Walleye	25	38	51	63	76
Sauger	20	30	38	51	63
Yellow perch	13	20	25	30	38
Black crappie	13	20	25	30	38
White crappie	13	20	25	30	38
Bluegill	8	15	20	25	30
Largemouth bass	20	30	38	51	63
Smallmouth bass	18	28	35	43	51
Northern pike	35	53	71	86	112
Channel catfish	28	41	61	71	91
Black bullhead	15	23	30	38	46
Common carp	28	41	53	66	84
Bigmouth buffalo	28	41	53	66	84
Smallmouth buffalo	28	41	53	66	84

For most fish, 30-60 or 40-70 are typical objective ranges for “balanced” populations. Values less than the objective range indicate a population dominated by small fish while values greater than the objective range indicate a population comprised mainly of large fish.

Relative weight (Wr) is a condition index that quantifies fish condition (i.e., how much does a fish weigh for its length). A Wr range of 90-100 is a typical objective for most fish species. When mean Wr values are well below 100 for a size group, problems may exist in food and feeding relationships. When mean Wr values are well above 100 for a size group, fish may not be making the best use of available prey.